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## Alcohol Intervention Studies in University Students. Randomised Controlled Trials of Responsible Beverage Service and High Risk Drinking.

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From

Clinical Alcohol Research, Malmö University Hospital,  
Department of Health Sciences, Lund University, Sweden

## **Alcohol Intervention Studies in University Students**

Randomised Controlled Trials of  
Responsible Beverage Service and High-Risk Drinking

**Kent O Johansson**



**LUND**  
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### **Akademisk avhandling**

Som, med vederbörligt tillstånd av Medicinska Fakulteten  
vid Lunds Universitet, för avläggande av doktorsexamen i  
medicinsk vetenskap i ämnet psykiatri, kommer att offentligen försvaras i  
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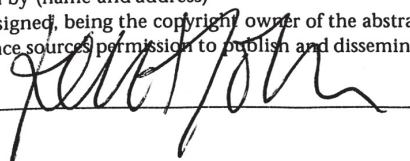
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Title and subtitle Alcohol Intervention Studies in University Students Randomised Controlled Trials of Responsible Beverage Service and High-Risk Drinking		
Abstract <p>The aim was to study implementation and efficacy of two intervention techniques for risky alcohol consumption in university students. One technique was a responsible beverage service programme modified for use in student's pubs. The other was a cognitive-based education programme (10 hours) for freshman students with risky alcohol consumption that was compared with a mailed personalised drinking feedback. We used randomised controlled trials to examine the efficacy of the interventions. In order to study the influence of a responsible beverage service, a training programme was given to bartenders at local student pubs (n=12) in a random way. Bartenders at six 'nations' (n=40) were trained under the responsible beverage service programme. The efficacy was assessed by measuring the breath alcohol concentration of patrons, and the social atmosphere as reported by patrons (N=1,918), in pubs with trained and untrained bartenders respectively, initially and after one and five months. In the high-risk drinking study the highest quarter of the students were randomised to one of the two interventions. The effectiveness of two intervention programmes was tested on 177 high-risk drinking freshmen, from a sample of 695 freshmen. The efficacy was measured with the AUDIT instrument before, and annually for three years after the intervention. In order to monitor drinking patterns during the years at university, a randomly allocated low-risk group (n=182) from the total sample was added for the trajectory analysis. The analysis was performed with the groups both combined and separated. Both programmes could be successfully implemented in a university setting. In the bar study the implementation phase attracted only positive reactions. Measuring breath alcohol levels had no serious drawbacks. There were no drinking competitions and only one person refused to participate. The freshmen study also received positive attention. Almost all students accepted participation (95%), indicating acceptance of the programme, both by the individuals and the organisations they belong to. The bar study showed that alcohol levels among the patrons in the intervention bars were decreased and the 'rowdy' social atmosphere reduced, compared with the patrons in the control bars after one month. These differences disappeared at the five-month assessment. The freshmen study found no significant differences between a more extensive cognitive behavioural skills training programme and a post-mailed minimal intervention in reducing alcohol consumption and related problems after one year or during a three-year follow-up period. The drinking pattern study revealed that 16% had a stable high-risk drinking pattern, 11% decreased their drinking pattern from risky to non-risky and 13% increased their drinking pattern from non-risky to risky. 60% maintained a stable low drinking pattern during all four years at university.</p>		
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# **Alcohol Intervention Studies in University Students**

Randomised Controlled Trials of  
Responsible Beverage Service and High-Risk Drinking

**Kent O Johnsson**

Clinical Alcohol Research, Malmö University Hospital,  
Department of Health Sciences, Lund University, Sweden  
2006



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# **CARPE DIEM**

**‘What you do today, not only creates the future but also the past’**

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## ORIGINAL PAPERS

The thesis is based on the following papers, which will be referred to in the text by their Roman numerals.

- I     Johnsson K.O., Berglund M.  
**Education of key personnel in student pubs leads to a decrease in alcohol consumption among the patrons: a randomised controlled trial.**  
*Addiction*, 98, 627-633, 2003
  
- II    Johnsson K.O., Berglund M.  
**Responsible beverage service and key personnel in student bars: a five-month follow-up of a randomised controlled trial.**  
*Manuscript*
  
- III   Johnsson K.O., Berglund M.  
**Comparison between a cognitive alcohol programme and post-mailed minimal intervention in high-risk drinking university freshmen: results from a randomised controlled trial.**  
*Alcohol and Alcoholism*, 41(2), 174-80, 2006.  
(By permission of Oxford University Press)
  
- IV    Johnsson K.O., Leifman A., Berglund M.  
**Changing drinking pattern? Trajectories of AUDIT scores during the first four years at university.**  
*Manuscript*

# INTRODUCTION

## Drinking during early adulthood

### *Onset*

The rate of alcohol consumption varies during a person's lifetime. The pattern is complex, and consumption can vary over the week, season, year, and over the life span (1). The *onset age* of alcohol consumption varies, with a peak at 18. This pattern is quite similar in both Europe and North America (2). Early onset is linked with increased negative consequences such as blackouts, tolerance, increased frequency of consumption, heavy drinking, abuse, dependence, and injuries while intoxicated (3-15).

### *Drinking during early adulthood*

Alcohol consumption per week and binge drinking episodes (5 drinks per drinking episode for men, 4 for women, with one drink containing approximately 12 g alcohol) normally reach a peak around 20-22 years, and then decline (4, 16, 17). Serdula et al. (18) analysed data ( $N=57,976$ ) from the Behavioural Risk Factor Surveillance System (BRFSS). They reported a prevalence of binge drinking of 24% between the ages of 18 and 20, 30% in the 21-25 age group, 20% between 26 and 34, and 13% in the 35-54 age group. When analysing data ( $N=87,145$ ) from the National Survey in Drug Use and Health (NSDUH), Miller et al. (19) reported that 34% of the 18-34 age group had engaged in binge drinking on at least one occasion in the previous 30 days, but only 16% for those over the age of 34. In both studies males were over-represented.

### *Risky alcohol consumption*

Different methods have been used to detect risky alcohol consumption in health care settings. Traditionally, general practitioners asked their patients about the total amount of alcohol consumed per week and recommended a decrease in consumption if the amount consumed exceeded a certain level. The latest recommendation is a Clinician's Guide for General Practitioners issued by the National Institute of Alcohol Abuse and Alcoholism (NIAAA) (20) where the number of daily drinks is limited to less than the binge drinking level, and the total number of drinks per week is recommended to be less than 14 (196 g alcohol per week) for males and 7 (98 g alcohol per week) for females. For those that exceed the limits for binge drinking on one or more occasions during a year, the prevalence of alcohol use disorders is 20%. The prevalence is 1 in 2 if they also exceed the weekly limit, and 8 percent if they only exceed the weekly limit. The Clinician's Guide also describes cut-off points for the AUDIT screening instrument (for more information about the instrument see the section "Alcohol screening").



Scores of eight or more for men and four or more for women are considered as risky consumption.

### ***Alcohol use disorders***

Two different diagnostic systems are used to classify alcohol use disorders (AUD): the Diagnostic and Statistical Manual of Mental Disorders (DSM) of the American Psychiatric Association (APA) and the International Classification of Diseases (ICD) issued by the World Health Organisation (WHO). Both instruments include alcohol dependence in what they are quite similar except for the numbers of criteria available. The ICD states that three criteria of six have to be fulfilled, and the DSM states three of seven, at some time during the previous 12 months. However, the systems are equally as effective in identifying dependence (21). The ICD system employs the concept of “harmful alcohol use” while the DSM system talks about “alcohol abuse”. The former is related to physical or psychiatric consequences and the latter to psychosocial consequences.

*Alcohol dependence* is confirmed (DSM IV) when at least three of the following have occurred at any time in the same 12-month period: 1) Tolerance; 2) Withdrawal; 3) Alcohol is consumed in larger amounts than intended; 4) Failure to cut down or control alcohol use; 5) A great deal of time is spent in activities relating to obtaining alcohol, consuming it or recovering from its effects; 6) Important social, occupational or recreational activities are given up or reduced because of alcohol use; 7) Alcohol use is continued despite it causing physical or psychological harm. According to DSM IV, *alcohol abuse* is confirmed when at least one of the following have occurred within a 12-month period: 1) Failure to fulfil major role obligations; 2) Exposure to physical hazards; 3) Legal problems; 4) Social or interpersonal problems.

All types of alcohol problems are highly prevalent in the 18-29 age group (22-28). In the NESARC survey (National Epidemiologic Survey on Alcohol and Related Conditions) (29) of the total prevalence of 12-month DSM IV alcohol abuse and dependence in 2001-2002, nine percent of males and females between the ages of 18 and 29 were diagnosed as being dependent on alcohol, four percent between 30 and 44 and two percent between 45 and 64. Corresponding figures for alcohol abuse are 7, 3 and 1 respectively. Males are over-represented in all four groups.

One explanation for the high prevalence of alcohol use disorders in the twenties is excessive alcohol consumption. This seems to be reduced later in life (30) as alcohol consumption and the prevalence of dependence declines (29). At least two explanations can be found for this decrease. There is either a maturing-out effect (23, 31, 32) where drinkers become more experienced as drinkers and have greater responsibilities, or the diagnostic instruments (i.e. DSM IV and ICD 10) are not well suited to this age group (i.e. 18-25) because of the lack of severity index.

## ***College drinking***

### **Transition period**

During the transition from high school to college, many young adults increase their alcohol consumption (33). Bear et al. (34) identified risk factors associated with increases in frequency and quantity of alcohol drinking. Increases in frequency were strongly associated with residence in a fraternity (male college living) or a sorority (female college living), and increased quantity was associated with male gender, residence in a fraternity or a sorority, and history of conduct disorders.

### **Drinking in college**

College students are more likely to have higher prevalence rates of alcohol use and higher rates of heavy use but lower rates of daily drinking than their non-student peers (16, 35, 36). As in the general population, males are more likely to engage in alcohol drinking, especially heavy drinking (16). The same situation is reported in a Swedish study from the late 1990s (37). However, a recent Swedish study comparing students and non-students reported no differences in total consumption or in drinking pattern between the two groups (38).

### **The college setting**

O'Malley & Johnston (16) reported that students who attend college had lower rates of heavy drinking at high school than those who do not attend college, in contrast to the situation when they are in college a few years later. Slutske et al. (36) compared twins attending and not attending college and found that the college twins reported higher alcohol consumption than the non-college twins. This higher consumption at college could be explained by the lack of parental control and experimenting with alcohol drinking between the ages of 18 and 25. This increase in drinking does not seem to continue after the college years. Muthén & Muthén (4) reported that those who attended college had lower levels of heavy drinking in their late thirties than their non-attending peers, indicating that risky alcohol consumption during college years is reversible.

### **Mechanism of heavy drinking during college years**

One reason for heavy drinking is the lack of perceived risk of hazardous alcohol consumption. A study conducted by Vik et al. (39) reported that two-thirds of the heavy-drinking college students did not recognise the need to reduce their alcohol consumption, despite evidence of high tolerance and negative drinking consequences. Another reason is the misconception in the norm system about the use of alcohol and other drugs among peers. In their study using data from surveys representing over 100 diverse college campuses in the US, Perkins et al. (40) found that students substantially overestimated how often the average student used alcohol and other drugs, and a number of studies have showed that perceived drinking norms are correlated to the students own drinking (40-42). Similar findings have been reported by Andrews et al. (43) in non-college settings.

Apparently, social factors influence alcohol consumption in young adults, and these have been reported in a review by Borsari & Carey (44).

## **Screening and intervention**

Several methods of intervention in high-risk alcohol consumption have been reported in literature. The intervention can be done directly with individuals but also in identified high-risk settings such as bars or pubs where a training programme could help the bartender avoid over-serving. Brief intervention is a method used for intervention directly for individuals with risky alcohol consumption, and Responsible Beverage Service is a method for intervention in high-risk settings. Both methods are described in later chapters. Brief intervention programmes for high-risk drinking were first developed and tested on middle-aged men, and the first controlled trial, in Malmö, was reported by Kristenson et al. (45) in the beginning of the 1980s.

### ***Brief intervention for risky alcohol consumption in populations not seeking treatment***

Brief intervention is normally characterised by its short duration, typically 5-60 minutes of counselling and training in one or several sessions. The sessions are aimed at providing early intervention, before or soon after the onset of alcohol-related problems (46). Normally a medical doctor or nurse provides the intervention in a health care setting. The content of different programmes varies but most programmes are instructional and motivational with information feedback, health education, skills-training and practical advice.

Several reviews have concluded that brief intervention is more effective than control conditions (47-51), but most studies have not focused exclusively on young adults. A reason for this could be that brief intervention programmes normally were given at health care centres and this age group (18 to 30) is underrepresented as treatment-seeking patients in general. However, Grossberg et al. reported significant reductions in alcohol use for young adults who underwent brief intervention compared with controls, and the effect sizes were similar to older populations (52). Several studies report lasting long-term effects of brief intervention programmes (53-56).

### ***Alcohol screening***

A number of self-reporting screening tests have been developed in the last decades. An early test was the Michigan Alcoholism Screening Test (MAST) developed in the early 1970s by Selzer (57), and later modified to a Swedish version (Mm-MAST) (58). In the mid-1980s the shorter CAGE instrument, consisting of four questions, was developed (59) and in the 1990s the 10-item Alcohol Use Disorders

Identification Test (AUDIT) (60), which may be more efficient at identifying early problem drinking (61). The instrument covers the domains of alcohol consumption, drinking behaviour and alcohol-related problems, and was originally designed by the World Health Organisation to screen for hazardous alcohol intake in primary health care settings. The instrument has good sensitivity and specificity (62, 63). Bergman et al. translated the instrument into Swedish with good statistical characteristics (64). The AUDIT instrument could also be used to measure changes in drinking patterns (65-70). In addition to the instruments described above and several other instruments not described in this chapter, biological markers are used to identify risky alcohol consumption.

### ***Responsible Beverage Service***

Influencing alcohol consumption in bars by offering training programmes to servers has received attention during the last decades. The majority of studies report positive results (71-73) but the lack of randomised controlled trials has resulted in non-conclusive reports. Instead, evaluation methods have been used to monitor the incidence of driving while intoxicated, and assessing the impact of training on server awareness, attitudes and behaviour, the numbers of interventions made by the servers, use of pseudo-patrons, etc.

One of the early evaluations of server interventions, the Navy Server Study (74), revealed that the likelihood of a patron being intoxicated was halved (from 33% to 15%), although absolute consumption and rate of consumption were unaffected by the programme. In their study conducted in Park City, Utah, Howard-Pitney et al. (75) found no differences in intervention effects between the treatment and the control servers. Gliksmann et al. (76) found that their programme appeared to have been effective in changing behaviour, in that trained servers exhibited less inappropriate behaviour than did untrained servers. In an evaluation of a responsible server programme, Simons-Morton & Cummings (77) found that such a programme produced significant improvements in the participants' perception of their role in preventing drunk driving. In a recent study, Toomey et al. (78) found that alcoholic beverages were served to actors pretending to be intoxicated patrons in 68% of first purchase attempts and 53% in second purchase attempts.

A long-term study by Buka & Birdthistle (79) showed that trained servers showed significantly higher levels of desired serving behaviour than non-trained servers fifteen months after the training. After four years, the desired serving behaviour remained higher than pre-training levels. A study by Wallin et al. (80) in Stockholm showed that actors playing the part of intoxicated patrons were served alcohol in 95% of the licensed premises they visited. Three years after the training programme, the actors were denied service of alcohol at 47% of the licensed premises, a statistically significant improvement compared to 5% in the baseline study.

### ***Intervention in university settings***

During the late 1980s and at the start of the 1990s Marlatt et al. (81) introduced their cognitive behavioural model with the aim of reducing high-risk alcohol consumption among college students. For the first time a more structured brief intervention programme was developed for college students. From the same research group, Kivlahan et al. (82) reported significant decreases in weakly consumption for those that underwent intervention compared with controls. Today there is evidence that several models successfully reduce high-risk drinking: cognitive behavioural skills training, expectancy challenge, brief motivational intervention, and personalised drinking feedback.

In 2002, the Task Force on College Drinking (83) published a review of available evidence of interventions in college populations, including recommendations for further strategies. Three methods were regarded as showing strong evidence for efficacy: cognitive-behavioural skills-training with norm clarification combined with motivational enhancement intervention, brief motivational enhancement intervention, and methodology with challenged alcohol expectancies.

#### **Cognitive skill-based intervention and motivational techniques**

The Alcohol Skills Training Program (ASTP) (81) teaches the students the basic principle of moderate drinking and how to cope with high-risk situations. The ASTP also includes topics like social drinking norms and the challenge of alcohol expectancies. The aim of the programme is to reduce harmful alcohol consumption and associated problems by using a skills-based curriculum. The programme significantly reduced alcohol consumption and alcohol-related problems compared with randomised controls after 1 year (82) and 2 years (84) respectively.

Within the framework of ASTP, Marlatt et al. developed a shorter version called BASICS (Brief Alcohol Screening and Intervention for College Students – a Harm Reduction Approach) (85), consisting of only two individual sessions, and with some components based on motivational interviewing. This intervention is also based on harm-reduction using a non-confrontational approach. The BASICS programme significantly reduced both alcohol-related problems and alcohol consumption compared with randomised controls at 2-year (23) and 4-year follow-up assessments (86). The results have been confirmed in other studies. Murphy et al. (87) reported that the BASICS programme was more efficient in reducing heavy drinking than a single session of drinking-related feedback or an assessment-only control after both 3 and 9 months. Larimer et al. (88) studied brief motivational enhancement with feedback components. They showed that a brief motivational enhancement combined with skills-training intervention, given at fraternities, significantly reduced alcohol use and typical peak blood alcohol concentrations. In the study they used both experts and peers as trainers and both reported similar results.

### **Expectancy challenge**

Challenging alcohol expectancies seems to have a short-term effect on alcohol consumption. Darkes and Goldman tested the efficacy of challenging expectancies in two studies (89, 90). Both studies reported that subjects randomly assigned to expectancy challenge significantly reduced alcohol consumption compared with subjects randomly assigned to control or traditional information after four or six weeks respectively.

### **Personalised drinking feedback**

The Task Force on College Drinking did not include personalised feedback in their recommendations, but several studies have reported positive effects using this method. In a study by Walters et al. (91), high-risk drinking college students were randomly assigned to one of three groups: 1) information and motivation session plus mailed feedback, 2) mailed feedback only, and 3) no treatment. In a 6-week follow-up, students in the mailed feedback group significantly reduced their drinking more than controls. No other differences were statistically significant.

Agostinelli et al. (92) reported that mailed normative feedback decreased drinking more than in controls assessed after six weeks. Collins et al. (93) showed that a personalised normative feedback decreased consumption and frequency of heavy episodic drinking compared with controls after six weeks but not after six months. A study by Neighbors et al. (94) evaluated the efficacy of a computer-delivered personalised normative feedback. The results showed that normative feedback was effective in changing perceived norms as well as alcohol consumption after 3- and 6-month follow-up assessments.

In a double blind randomised controlled trial Kypri et al. (68) tested a web-based screening and intervention programme (e-SBI) aimed at reducing hazardous drinking. At six weeks, subjects receiving the e-SBI intervention reported significantly lower total consumption, lower heavy episode frequency and fewer problems than subjects receiving leaflets on the health effects of alcohol. After six months there were fewer personal and academic problems in the intervention group. Most of these studies have included drinking scores in relation to drinking pattern at university and corrections of norm misperception.

## AIMS

The overall aim of the present thesis was to use randomised controlled trials to examine the efficacy of different prevention methods aimed at decreasing high-risk consumption in university students, with regard to both short-term and long-term effect. The following questions were addressed:

1. Does the mean breath alcohol concentration (BrAC) decrease, and perceived social atmosphere ('rowdy', 'high' or 'cosy') change, among the patrons in student pubs with trained bar personnel compared with the patrons in the pubs with non-trained bar personnel?
2. Does the mean BrAC among the patrons in student pubs with trained personnel remain lower, and does the atmosphere remain less rowdy, at the five-month follow-up compared with the control pubs?
3. Is a more extensive cognitive behavioural skills training programme more effective than a post-mailed minimal intervention in reducing alcohol consumption and related problems after one year in a group of freshmen?
4. Do cognitive-behavioural skills-based intervention and personalised drinking feedback have different long-term effects (4 years)?
5. What are the rates of changes from risky to non-risky drinking, and from non-risky to risky drinking, during the first four years at a university, and how do these relate to background variables?

# MATERIALS AND METHODS

## Samples

### *Responsible Beverage Service (Papers I & II)*

In Papers I and II, the sample consisted of 1,918 students visiting 12 different local student pubs during ordinary pub evenings in 1997. The selection of the participants in the study was designed so that when one test was completed, the next patron visiting the bar was asked to participate in the study. In total about 2,300 students visited the 12 different pubs during the baseline assessment and approximately the same number at each subsequent assessment. Members from the research team and persons responsible for the pubs estimated these figures separately. The sample is described in Table 1.

*Table 1. Distribution of gender and age at baseline, 1- and 5-month follow up*

	BASELINE		1-MONTH FOLLOW-UP		5-MONTH FOLLOW-UP	
	<i>Intervention</i>	<i>Control</i>	<i>Intervention</i>	<i>Control</i>	<i>Intervention</i>	<i>Control</i>
Number	363	301	360	298	338	255
Male	71.6%	71.4%	61.9%	68.8%	64.8%	65.1%
Female	28.4%	28.6%	38.1%	31.2%	35.2%	34.9%
Age (SD)	21.8 (1.9)	22.3 (2.4)	22.2 (1.9)	22.4 (2.2)	22.5 (2.3)	22.6 (2.1)



### ***High-Risk Drinkers (Papers III & IV)***

All freshmen at the Faculty of Engineering in 1996 were asked to participate in a four-year longitudinal study of their alcohol use, including a long or short intervention for risky alcohol consumption for those with the highest (upper quartile) AUDIT scores. A total of 660 out of 693 (95%) agreed to participate in the study (495 males, 165 females), and the mean age at baseline was 21±3 yrs. The sample is described in Table 2.

*Table 2. AUDIT scores at baseline [mean (SD)] in the total population, by gender*

Total number	660
Male/Female	495/165
Age (SD)	21 (3)
10 item AUDIT	
Total	8.5 (2.9)
Male	9.3 (2.8)
Female	6.3 (3.5)

In Paper III, a study sample consisting of 177 high-risk drinkers in the highest quartile of the total sample was selected and offered one of two interventions: 1) Cognitive Behavioural Alcohol Programme (CBAP), or 2) Post-mailed Minimal Intervention (PMMI). The characteristics of the sample and its AUDIT scores are presented in Table 3. In Paper IV a selected randomised sample of low risk consumers ( $n=182$ ) was added. The selection was made in order to match gender and curriculum.

*Table 3. AUDIT scores at baseline [mean (SD)] in the high-risk group, by gender and type of intervention*

	CBAP	PMMI
Total number	89	88
Male/Female	67/22	66/22
Age (SD)	21 (3)	21 (3)
10 item AUDIT		
Total	12.4 (3.6)	12.8 (3.8)
Male	13.7 (3.1)	13.9 (3.3)
Female	9.0 (2.6)	9.7 (3.5)

## Design

### *Responsible Beverage Service*

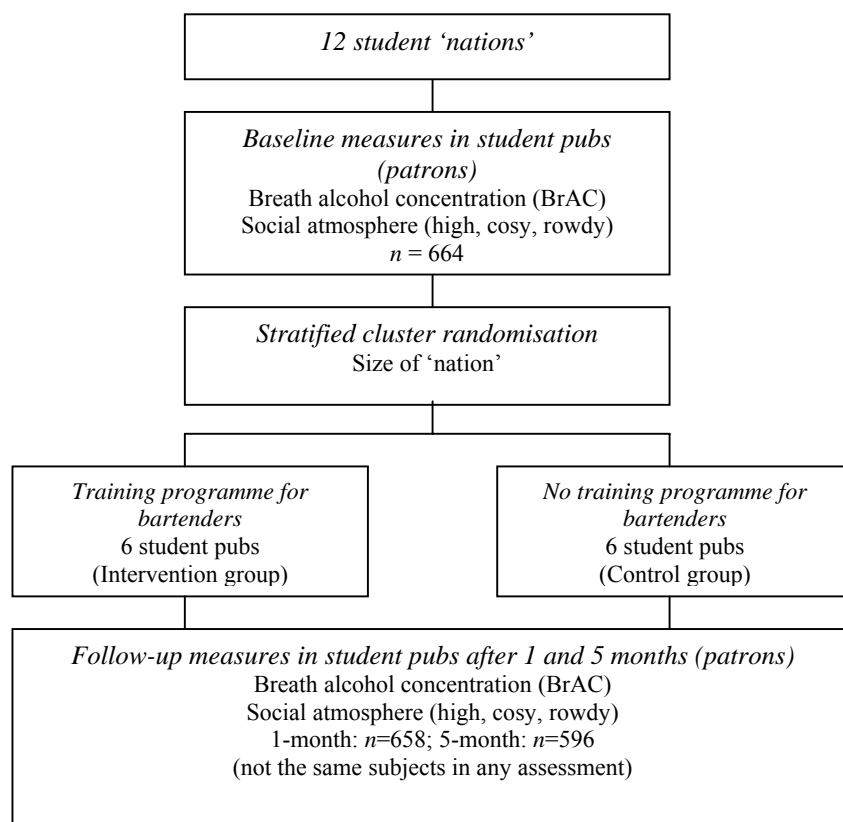


Figure 1. The design of the pub study

Before the study was initiated, the chairman of the joint organisation (Kurators Kollegiet), which represents all twelve pubs, contacted the research team because of a concern about excessive drinking among patrons. Information about the research study was given at a joint meeting, where the chairmen of all twelve pubs were represented. All were positive to the intervention but accepted that their pub could be randomised to the control group.

Six of the twelve student 'nations' at Lund University, stratified in relation to the number of members, were randomly selected to participate in the training programme. Before the randomisation, a baseline assessment was conducted. One

'nation' was later excluded from the control group as the pub was under renovation and no alcohol was served during the time of the study. The follow-up assessments were performed on the same weekdays and under conditions as similar as possible to the baseline study. The times of the surveys were decided without the bartenders' knowledge, and only ordinary pub evenings were included. The design is presented in Figure 1.

It was not practically possible to perform an individual randomisation, either on the level of bartenders or of the patrons. The research area of Responsible Beverage Serving lacks studies with a randomised approach, which is a necessity for progress in the field. We therefore decided to use a cluster randomisation design with the "nations" (organisations of students and owner of the pubs) as the allocation unit.

### ***High-Risk Drinkers***

At one of the routine information meetings during the two introductory weeks, all freshmen were given 30 minutes of information (oral and written) about the research programme. A member of the research team gave the information. The students were then immediately asked to complete the Alcohol Use Disorder Identification Test (AUDIT) and sign the informed consent form if they agreed to participate in the study. After the baseline assessment a randomised procedure was conducted, based on a computerised random sample programme (95), stratified according to gender and department affiliation. The students with an AUDIT score in the highest quartile (male  $\geq 11$ ; female  $\geq 7$ ) were randomised to a Cognitive Behavioural Alcohol Programme (CBAP) group or to a Post-Mailed Minimal Intervention (PMMI) group. The design is presented in Figure 2.

The follow-up assessments were conducted annually for three years after the baseline assessment, using questionnaires sent by post. There were no differences in the follow-up procedures between the intervened groups ( $n=177$ ) and the low-risk group ( $n=182$ ), and the response rates were similar between groups. No feedback was given to the different groups at follow-up assessments. A questionnaire was sent to each of the subjects in the study. Those not responding received questionnaires on two more occasions as reminders. If there was still no response, the subjects were contacted by telephone and, if possible, the questionnaire was completed directly over the telephone.

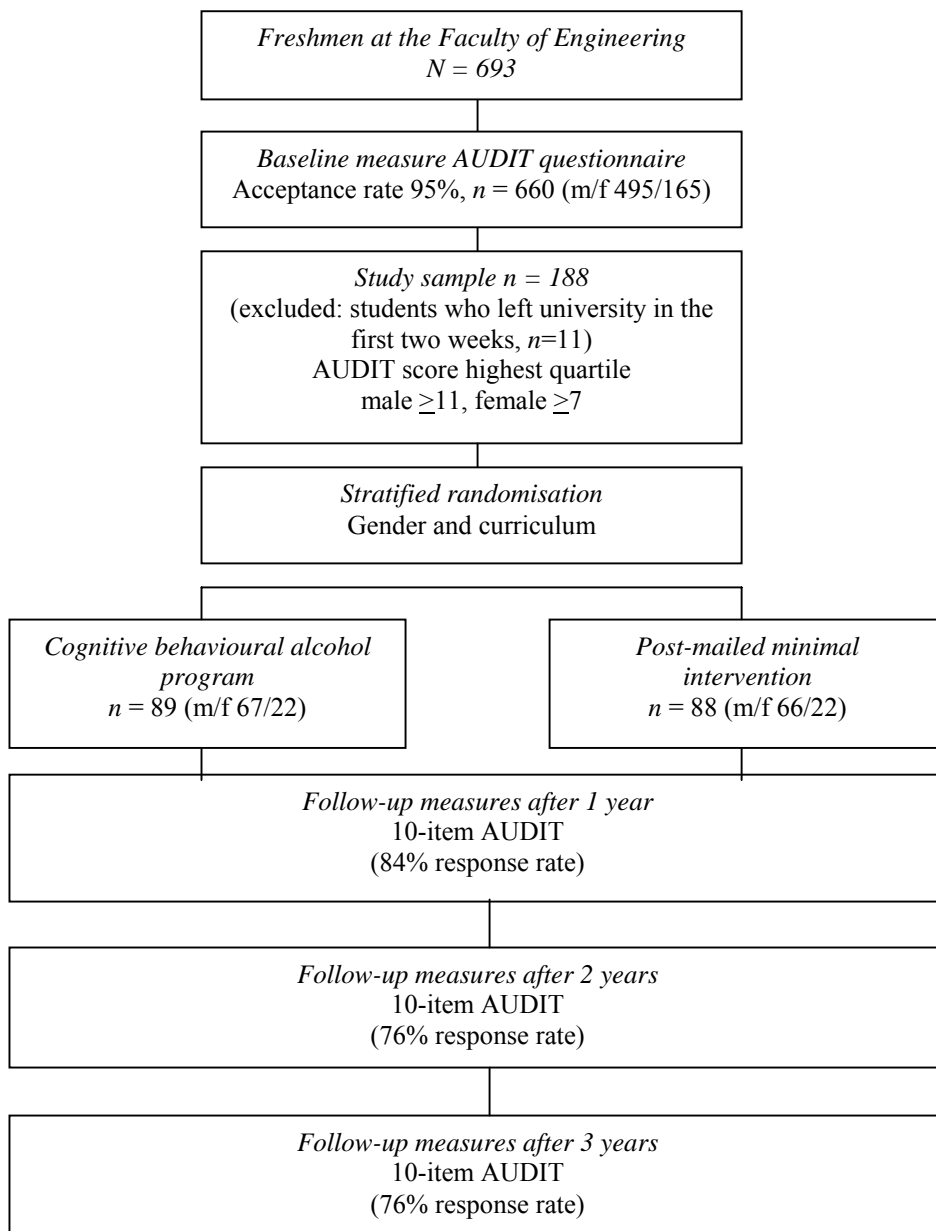


Figure 2. The design of the freshmen study

## **The study methods**

### ***Responsible Beverage Service***

#### **Assessment**

A breath analyser [Lion Alcometer™ SD-400 (400i.07), PALMENCO AB] (96, 97) was used to measure the breath alcohol level (BrAC) on all assessment occasions. The instrument was regularly calibrated according to the manual and the same instrument was used for all the measurements. Before the BrAC was tested, the participants were asked to rinse their mouths with water. Directly after the BrAC tests were finished, the patrons were asked to subjectively rate the social atmosphere of the pub according to a Visual Analogue Scale (VAS). The scale, ranging from 0 to 100, included three different categories: 'cosy', 'high' and 'rowdy'. To avoid the same patron participating twice during the evening, two members of the research team conducted the survey together.

#### **Training programme**

After the randomisation, a total of 40 students working as bartenders in the different pubs, attended the training programme. The programme was ten hours in total, and was held on two different occasions. The students attending the programme were responsible for the total amount of alcohol served in the pub during a pub evening. An annual total of approximately 1,200 students are involved in serving alcohol in all twelve pubs, and about 6 to 10 persons work during a pub evening.

One of the key components of the bartender training programme was the bartender's own relation to alcohol. This part of the training programme focused mainly on how to maximise the positive effects of alcohol consumption while minimising the negative effects. The programme was conducted in the form of an interactive dialogue, in which lectures were mixed with small or large group discussions led by experts. The programme was partly based on manuals, mainly the Alcohol Skills Training Programme (81) (content described in next chapter). The rest of the course was based on the Swedish version of the Responsible Beverage Service Programme (80, 98). This part of the programme was complemented with practical work behind the bar. A professional bartender taught the students how to mix non-alcoholic drinks as well as alcohol drinks. They were also taught how to conduct the bar work as professionally as possible. The aim of this was to increase bartender skills, and thereby self-confidence, so that the bartender would apply the practical responsible beverage service techniques learned on the programme.

## ***High-Risk Drinkers***

### **Assessment**

Before the randomisation, the baseline assessment was conducted. The follow-up assessment was performed one year later using questionnaires sent by post. A 10-item screening instrument, the Alcohol Use Disorder Identification Test (AUDIT) (99), was used as a measuring instrument. The instrument covers the domains of alcohol consumption, drinking behaviour and alcohol-related problems and was originally designed by the World Health Organisation to screen for hazardous alcohol intake in primary health care settings. The Alcohol Use Disorder Inventory Test was given to all freshmen before and after the interventions. In this study, the students in the quartile with the highest AUDIT scores were regarded as high-risk consumers.

### **Educational programme**

Students randomised to CBAP were invited to a ten-hour educational programme, spread over five different sessions. The invitation included feedback on their AUDIT scores. Each course was mixed by gender and was attended by eight to ten students. A member from the research team served as the main teacher and eight peers served as co-educators. They were trained in the programme and previously responsible for the introduction of freshmen. The content of the educational programme was taken from an early unpublished version of the BASICS manual, and was similar to the published manual. The following modules were used in our programme: 1) Identify High Risk Drinking Situations, 2) Provide Accurate Information about Alcohol, 3) Identify Personal Risk Factors, 4) Challenge of Myths and Positive Expectations, 5) Establish Appropriate and Safer Drinking Goals, 6) Managing High Risk Drinking Situations, and 7) Learn from Mistakes.

*Session 1* started with feedback on the students' AUDIT scores assessed at baseline. After that, the session focused on the students' own expectancies of alcohol use. *Session 2* focused on facts and myths about alcohol. The participants also learned how to calculate their blood alcohol level. A special journal was introduced so that participants could self-monitor alcohol consumption during the course. *Session 3* concerned gender roles and alcohol. *Session 4* was a simulated alcohol-drinking session where a typical party atmosphere developed without any alcohol consumed. At the end of the session, alcohol expectancies were discussed. *Session 5* taught the students how to 'plan' their alcohol consumption at a party. The focus was on drinking-moderation strategies, drinking refusal, peer influences, assertive behaviour, identification of high-risk situations and negative emotional states.

Students randomised to PMMI received written feedback on their AUDIT scores that was sent by post. The students were given information about their scores in relation to all other freshmen. They were informed if they belonged to the upper quartile (25%) with the highest score and the score was plotted into a diagram, in which the different quartiles were shown (Figure 3). The feedback also included recommendations to drink less and, if necessary, get in contact with

treatment organisations such as the Student Health Care clinic or the local welfare care centre. The feedback also included the telephone numbers to these organisations. In contrast to more traditional normative feedback, no questions were asked about perceived drinking norms and, consequently, no specific feedback was given on that matter.

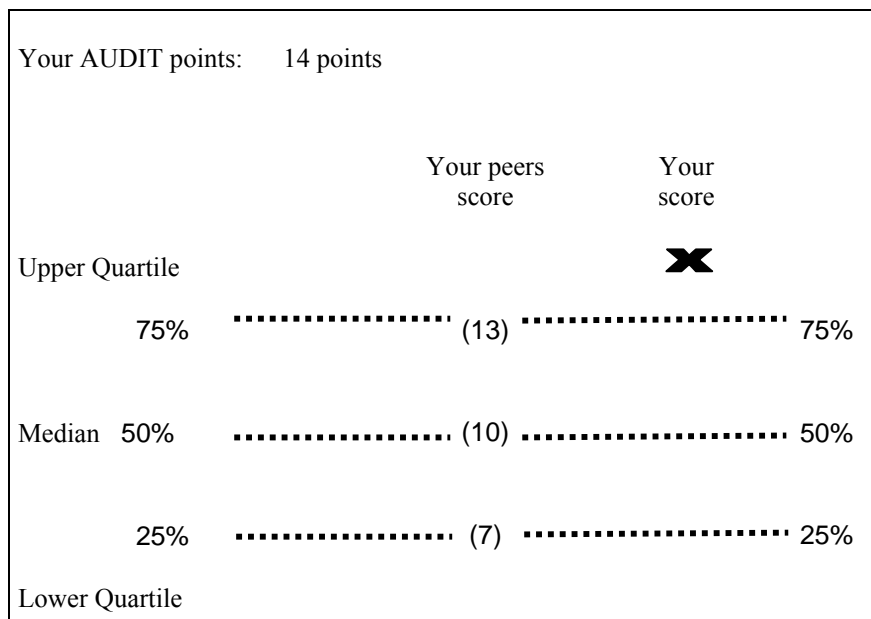


Figure 3. The feedback sheet, MALE

## **Statistics**

### ***Paper I***

Changes between the first and second examination in the intervention group compared with the control group were tested using regression analysis (100). An ANOVA test was used to test heterogeneity between patrons in different pubs. A Logistic Regression Analysis (100) was used to calculate differences between the experimental group and the control group for those subjects with a higher BrAC than 0.01%.

### ***Paper II***

The results of baseline, one-month follow-up and five-month follow-up were analysed using a univariate *F*-test to consider the effects of time and intervention by time interaction. Univariate variance analysis was used to study changes between the one-month and five-month outcomes in order to understand the results of the significant overall univariate variance analysis. SPSS 11.0 (95) was used for all calculations and the significance level was  $P < 0.05$ .

### ***Paper III***

The difference between sexes in the baseline AUDIT was tested using the Mann-Whitney U-test. Baseline differences between intervention groups were checked with an unpaired t-test. Changes between the first and second examination in all groups were tested with a paired t-test. Differences of changes between the two groups were tested by linear regression. The one-year AUDIT was regressed on treatment group as an indicator variable with baseline AUDIT as a covariate (101). Scale reliability was tested with Cronbach alpha. The SPSS program, version 11.0, (95) was used for all calculations.

### ***Paper IV***

Trajectory analyses were made using a semiparametric group-based model. A customised SAS procedure, developed with the SAS/TOOLKIT, was used (102). The Bayesian information criterion (BIC) was calculated to select the optimal model. The following formula was used:  $BIC = \log(L) - 0.5 * \log(n) * (k)$  where  $L$  is the value of the model's maximised likelihood,  $n$  is the sample size (observed number\*number of assessments –missing values) and  $k$  is the number of parameters in the model. The analysis was performed separately for subjects with high and low AUDIT scores respectively at the baseline assessment. Initially, men and women were analysed together (combined). The optimal model chosen was also tested separately by gender. The quadratic parameters gave the best models and were used in the analysis.



## RESULTS

### *Education of key personnel in student pubs leads to a decrease in alcohol consumption among the patrons: a randomised controlled trial (Paper I)*

BrACs of patrons in the intervention pubs were reduced by more than those of the patrons in the control pubs at one-month follow-up. The mean difference in BrAC between intervention and control groups was  $-0.011\%$  [95% confidence interval  $-0.022$  to  $0.000$ ]. The results are presented in Table 4. The intervention group also decreased more than the control group in the reported level of ‘rowdy’ social atmosphere. The mean difference was  $-6$  points [ $-11$  to  $-1$ ]. No differences were found in reported ‘cosy’ and ‘high’ atmosphere. The rowdy social atmosphere results are presented in Table 5.

Table 4. Breath Alcohol Concentration (BrAC) at baseline and changes at 1-month follow-up

	BASELINE mean, (SD)		CHANGES 1-MONTH FOLLOW UP mean, 95% [CI]		
	Intervention	Control	Intervention	Control	Intervention/ Control
Total	0.086% (0.052)	0.080% (0.050)	-0.004% [-0.012, 0.004]	+0.007% [-0.001, 0.015]	-0.011% [-0.022, 0.000]
Male	0.092% (0.051)	0.086% (0.049)	-0.005% [-0.015, 0.005]	+0.005% [-0.006, 0.016]	-0.010% [-0.024, 0.003]
Female	0.071% (0.052)	0.066% (0.048)	+0.003% [-0.010, 0.016]	+0.012% [-0.002, 0.026]	-0.009% [-0.028, 0.010]

Table 5. Rowdy social atmosphere at baseline and changes at 1-month follow up

	BASELINE mean, (SD)		CHANGES 1-MONTH FOLLOW UP mean, 95% [CI]		
	Intervention	Control	Intervention	Control	Intervention/ Control
Total	40 (25)	46 (24)	-7 [-10.35, -3.65]	-1 [-5.15, 3.17]	-6 [-11.30, -0.70]
Male	39 (24)	46 (24)	-8 [-11.91, -4.09]	+1 [-3.99, 5.99]	-9 [-15.28, -2.72]
Female	42 (27)	45 (23)	-7 [-13.01, -0.99]	$\pm 0$ [-7.89, 7.89]	-7 [-16.75, 2.75]

***Responsible beverage service and key personnel in student bars: a five-month follow-up of a randomised controlled trial (Paper II)***

Both BrAC (Figure 4) and the three social atmosphere variables (Figure 5) changed over time. In the previous paper it was reported that the atmosphere was less rowdy, and the BrAC was less at the one-month assessment. The change in both the BrAC and the social atmosphere variable was different between the first and fifth months compared with the trend in the first month. This shows that the positive results after one month were not stable and the differences between the two groups disappeared almost completely at the five-month follow-up. No significant differences were found between males and females.

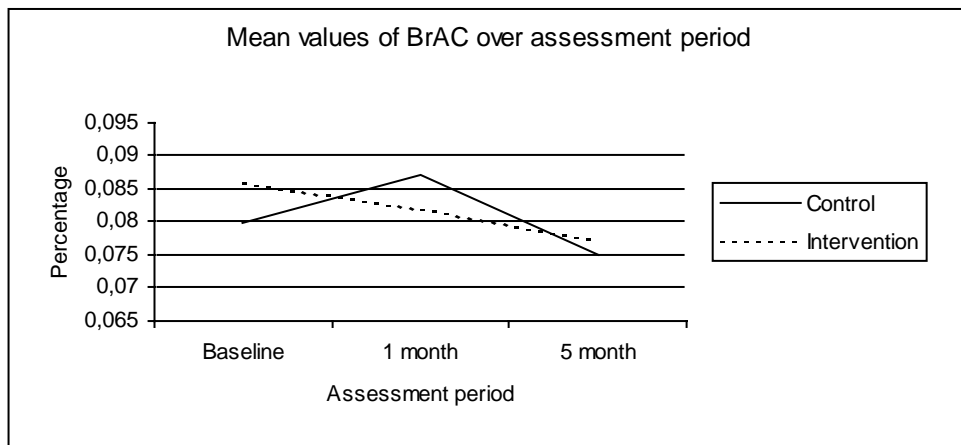


Figure 4. Mean breath alcohol concentration at baseline, 1 month and 5 months follow-up assessment, expressed in percentage

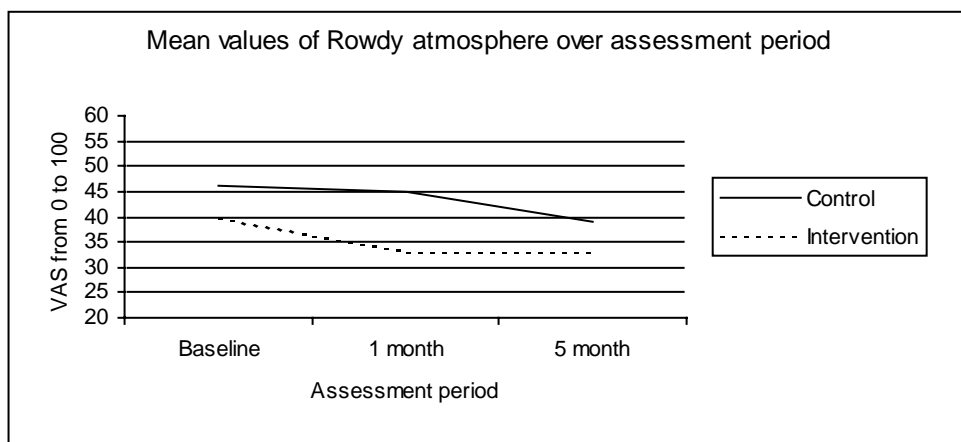


Figure 5. Mean rowdy scores at baseline, 1 month and 5 months follow up, expressed in points from 0-100

***Comparison between a cognitive alcohol programme and post-mailed minimal intervention in high-risk drinking university freshmen: results from a randomised controlled trial (Paper III)***

There were no differences in baseline data between the two intervention groups, either in the total group or in the gender-separated group. The mean AUDIT scores were  $13.4 \pm 3.6$  in the Cognitive Alcohol Programme group (CBAP) and  $12.8 \pm 3.8$  in the Post-mailed Intervention group (PMMI).

There were significant decreases in the total 10-item AUDIT scores as well as in the alcohol consumption subscale at the 1-year follow-up assessment, both in CBAP and PMMI groups.

There were no significant differences in the total 10-item AUDIT scale between the CBAP and PMMI groups. There were no significant differences between men and women. The results are presented in Table 6.

*Table 6. Changes in AUDIT-scores, means [95% CI] by study groups and gender between baseline and 1 year follow-up*

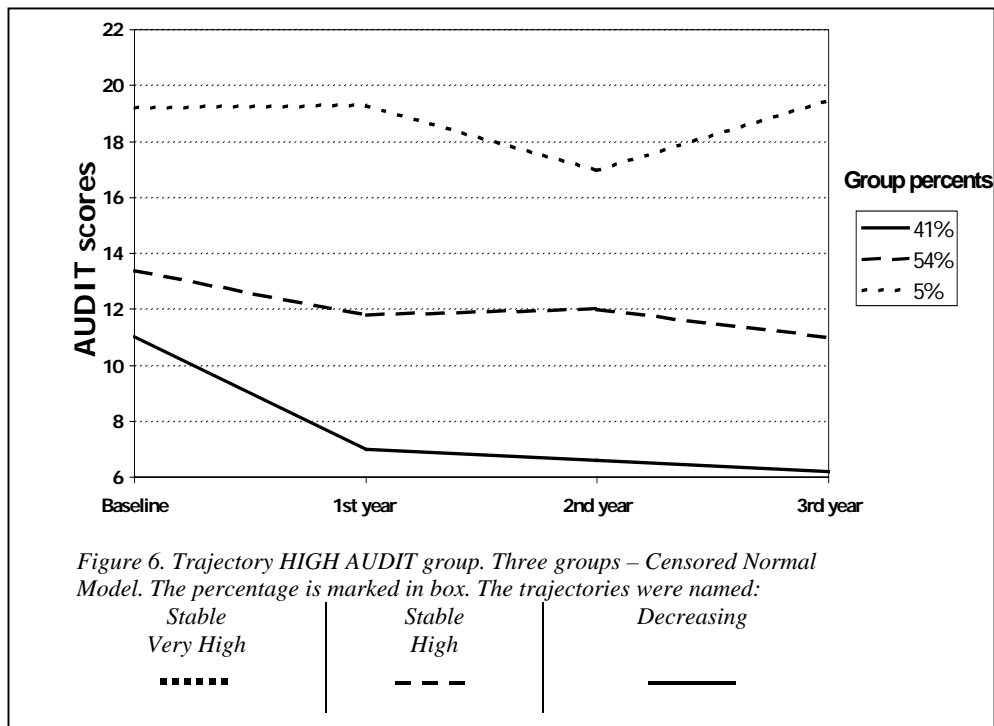
	CBAP	PMMI	Difference between groups	ANCOVA
AUDIT				
Total	-1.7 [-2.6, -0.7]	-2.7 [-3.6, -1.7]	-1.0 [-2.5, 0.4]	-0.8 [-2.0, 0.4]
Male	-1.7 [-2.9, -0.4]	-3.1 [-4.2, -1.8]	-1.4 [-3.2, 0.4]	-1.2 [-2.7, 0.3]
Female	-1.8 [-2.8, -0.8]	-1.9 [-3.3, -0.2]	-0.1 [-2.0, 1.9]	-0.3 [-1.4, 2.0]

***Changing drinking pattern? Trajectories of AUDIT scores during the first four years at university (Paper IV)***

**High Risk Group**

Three distinct trajectories were defined: Stable Very High (5%), Stable High (54%), and Decreasing (41%). Results are presented in Figure 6.

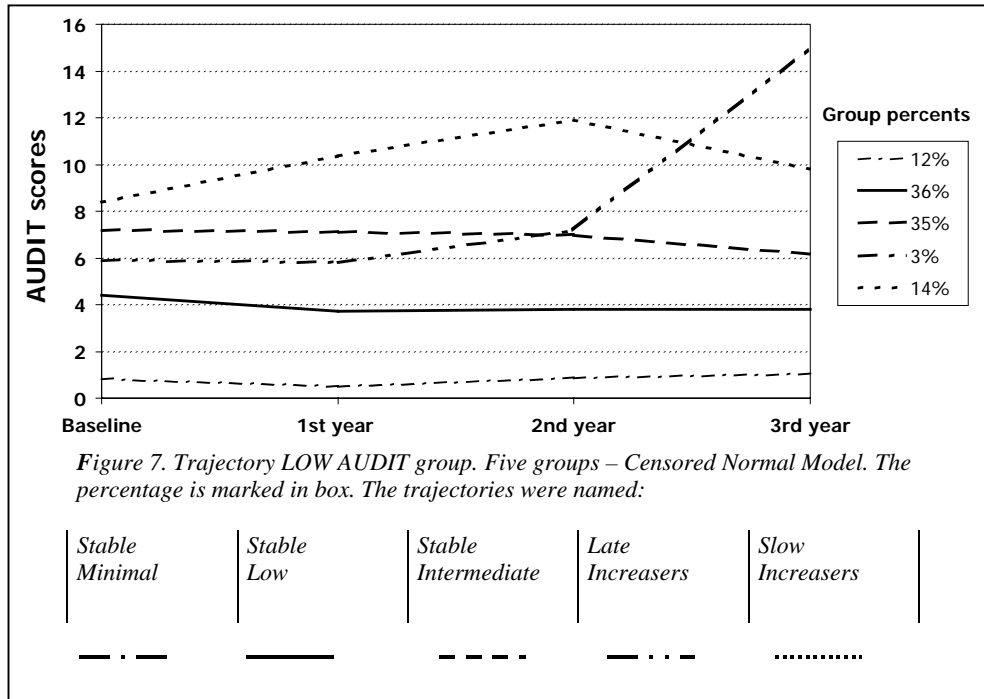
Males and females were first analysed together and then separately. The trajectories for males and females were similar, both in the combined and separated analyses. There were also proportionally more ‘Decreasers’ in the female group, both in the combined and gender-separated analysis (for both  $P < 0.001$ ).



### Low Risk Group

The following distinct trajectory groups were defined: Slow Increase (14%), Late Increase (3%), Stable Intermediate (35%), Stable Low (36%), and Stable Minimal (12%). The groups are presented in Figure 7.

As in the high-risk group, males and females were first analysed together and then separately in a second analysis. In the second analysis, male trajectories were similar to the combined analysis. For females, the gender-separated analysis resulted in a larger number of subjects in the increasing trajectory groups. In the Stable trajectory groups the differences found in the combined analysis did not remain in the gender-separated analysis because the women generally had lower AUDIT scores.



### **Type of intervention**

There were no significant differences between the short and long intervention. In the Stable Very High group the proportion of subjects was 4% (long) and 5% (short). In the Stable High group the proportions were 57% and 58% respectively, and 39% and 38% respectively in the Decreasing group.

### **Influence of department affiliation**

A separate examination was made of possible differences between subjects in the different departments. The departments were divided into three groups: 1) the 'gender equal group' ( $n$ =males 35/females 39), 2) the 'practical group' ( $n$ =134/42), and 3) the 'theoretical group' ( $n$ =96/13). The 'gender equal group' comprised the Architecture and Chemistry departments, where approximately 50% of the students are females. The 'practical group' was the Building & Environmental Technology and Mechanical Engineering departments. The 'theoretical group' comprised Computer Science, Electro Science, Physics, and Mathematics. In these two groups approximately 25% of the students are women. The analysis indicated no differences between the different groups.

### **Trajectories in the total population**

The frequencies of previously defined trajectories in the High-Risk and Low-Risk groups were integrated using weighted data (high group 27%, low group 73%). The two Stable High groups comprised 16% of the total sample, the Decreasing group (from high to low) was 11%, and the two Increasing groups (from low to high) 13%. The three Stable Low groups comprised 60% of the sample.

# GENERAL DISCUSSION

## Sample

The samples in this thesis comprised two different populations, both from the student body at Lund University. In Papers I and II, 40 bartenders from six pubs underwent a training programme, and the efficacy of the program was assessed on a total of 1,918 students (mean age 22) visiting local student pubs during ordinary pub evenings. This material may have some limitations, as all students do not visit student pubs and no data is available on the proportions or demographics of the student body that do visit student pubs during pub evenings. However, in comparison with data collected in other studies by the research group, and in similar populations, the data is representative for those that do drink alcohol. In a study presented at the ESBRA meeting 2003 (103), based on all freshmen ( $N=2,032$ , mean age 24) at two medium-sized universities in Sweden, the estimated blood alcohol concentration (104) when drinking alcohol was 0.087 percent for males and 0.076 percent for females. These figures can be compared with the present sample where the measured scores were 0.089 and 0.069 respectively. In the present sample 6% reported zero percentage at the baseline assessment, compared with 4% at the two medium-sized universities that reported total abstinence.

In Papers III and IV, the sample comprised 693 freshmen at the Faculty of Engineering (LTH). The Division for Student Affairs and the Office of Admissions produce statistical information annually about the grades necessary for candidates to be accepted as students in different departments at Lund University. Most of the eight departments require similar high-school grades for acceptance, which is similar to most other curriculum at the university.

The previously mentioned study at two medium-sized universities showed no significant differences in estimated blood alcohol concentration between those that studied at Faculty of Engineering and those that studied at other faculties.

In the freshmen study (Paper III) there was a high acceptance rate, which was higher than in most other intervention studies (86, 88, 91, 92, 94), and a high follow-up rate, which was similar to some important earlier studies (23, 86, 91, 92, 94). These high rates improve the general applicability, which must be thought to be very good for students at the Faculty of Engineering and good in students at other faculties.

## *Effects of interventions*

### **Responsible Beverage Service**

The training programme (RBS) for bartenders in student pubs is not widely used. However, the RBS method is well utilised in traditional bars. To our knowledge, the present study is the first to utilise a randomised technique and a direct assessment of breath alcohol concentration on patrons in all areas of responsible beverage service. Other studies are assessed in a non-randomised design.

Our positive results are similar to other studies in non-college settings. A reason for the positive result could be that students are positive to accepting methods that avoid over-serving, thereby reducing harmful consequences among their peers, who are also their patrons. Furthermore, most students working as bartenders are young and lack previous experience and are therefore more willing to accept the RBS method. This was shown earlier in a study by Buka & Birdthistle (79) in a non-student setting.

We used a cluster-randomised technique in the randomisation procedure, which was the only possible and practical approach. In the statistical analysis, the intraclass coefficient (ICC) was non-significant and therefore considered to be zero. If the ICC value is more than zero the power of the study would be reduced and the statistical analysis would probably not be significant.

In the study we used the technique to measure breath alcohol concentration directly on patrons, which must be considered an important improvement in the evaluation of RBS interventions. The technique involved no negative effects, such as drinking competitions among the patrons, so therefore this method could be recommended for use in future research.

### **Intervention for high-risk drinking**

Two different techniques were used to reduce alcohol consumption in high-risk drinkers - a ten-hour cognitive behavioural alcohol programme (CBAP) and a post-mailed personalised drinking intervention (PMMI). In our study, both programmes showed similar effects on AUDIT scores after one year. In an earlier study, Baer et al. (84) compared a six-week didactic classroom intervention to a one-hour intervention comprising feedback and skills-based components. At the two-year follow-up, both interventions showed similar and significant reductions in drinks per week. Furthermore, the present study design, with more extended intervention compared with mailed feedback, has been tested before and, as in our study, no differences were found between type of intervention (91, 105). A reason for the efficacy of the personalised post-mailed feedback could be that students often overestimate their peers' alcohol consumption and underestimate their own, which could promote risky alcohol consumption (39, 40). When this misconception is corrected the consumption is more likely to be closer to the mean for the population. More studies are required explicitly addressing the matter of optimal length of interventions. However, an analysis of effect sizes shows a similarity between short and long intervention, which has been reviewed in a meta-analysis



included in a report submitted to the Swedish Ministry of Health and Social Affairs (106) to form the basis of new alcohol legislation. The report was based on a total of 17 randomised controlled trials of college interventions. In studies comparing a cognitive behavioural programme with controls and measuring alcohol consumption, the combined (6 studies) effect size was 0.37 in favour of intervention, and when measuring binge drinking the effect size was 0.28, also in favour of intervention. In studies comparing personalised drinking feedback with controls, the combined effect size was 0.24 and 0.26 respectively in favour of intervention.

### ***Long term effects in general and college populations***

#### **Responsible Beverage Service**

No other study using the RBS technique has been utilised in college settings and most general studies of responsible beverage service only assess the short-term efficacy of the programme. Only two previous studies have assessed the long-term effect of an RBS programme, one in the USA and one in Sweden (79, 98). None of these studies measured the direct efficacy of the programme on patrons, and their programmes were either part of a community intervention programme or involved other organisations in the community. At the five-month follow-up in our study, we no longer found differences between intervention and control pubs. The programme received a lot of attention in both the local press and among the owners of the pubs, so one explanation for the lack of difference could be some leakage of effect from intervention servers to control servers.

#### **Intervention for high-risk drinking**

Some studies based on general population report long-term effects of their programmes and the follow-up periods are considerably longer, because the brief intervention programmes in general populations have existed for longer than the brief interventions for college students (53-56).

Few studies of student populations have measured the long-term effects of their programmes. Marlatt et al. assessed their cognitive skills-training programme after four years and found significant improvement in alcohol-related problems and alcohol consumption (86). Apart from that study, most other studies have shorter follow-up periods ranging from six weeks to 12 months, and studies involving drinking feedback normally assess the outcome after six weeks.

In our intervention study for freshmen at risk, we assessed the AUDIT scores annually in three subsequent years but found no delayed effects of the two given interventions.

### ***Drinking patterns during the university years***

In both the USA and Sweden, the years between 18 and 25 comprise the period when most alcohol is consumed and when there is the greatest frequency of binge drinking (6, 24, 38, 107-109). In order to identify different drinking trajectories we used a semiparametric group-based approach (110) for modelling developmental trajectories. The number of stable high-risk consumers found in this study (16%) corresponds well with several other studies (31, 111-113), but some studies report higher rates (114, 115). The 13% found in the increasing group also corresponds with figures reported in most other studies (31, 111-114). Eleven percent of our population reported a decreasing pattern, which is similar to that shown in other studies. However, some studies reported no decrease at all (14, 114-116) and some showed higher levels of decrease (112). Almost all studies, including ours, reported the same frequency of stable low trajectories, ranging from 60% to 70%.

Males were over-represented in the Stable High group, and females were more likely to be over-represented in the Decreasing group, indicating that male gender is a risk factor.

The initially high-risk AUDIT groups received either a short or a long intervention but no significant differences were found in trajectories between the groups and no late effects of interventions occurred. Students from eight different departments were included in the study. The curriculum affiliation did not affect the trajectories in this population.

Our trajectories are similar to those in other studies, regardless of whether the same analysis method is used (31, 111-113). However, compared with longitudinal studies, we had a small number of subjects, which could mainly be attributed to the design of the study (i.e. intervention study). Longitudinal studies in university settings are unusual in Europe, which could justify the present analysis.

### ***Implications for Student Health Care***

Several methods aimed at preventing high-risk drinking in college settings have been tested during the last decades. The Task Force on College Drinking (83) recommended three methods that showed strong evidence of efficacy: cognitive-behavioural skills with norm clarification combined with motivational enhancement intervention, brief motivational enhancement intervention, and methodology with challenged alcohol expectancies. Recently, a fourth method has been shown to be equally effective - the personalised drinking feedback (68, 91-94).

Sometimes it could be difficult to implement randomised controlled studies in practical work. In our freshmen study we found that a short intervention, the personalised drinking feedback, was as effective as a longer intervention. This finding was also supported in a report to the Ministry of Health and Social Affairs (106) where a similarity in effect was shown between short and long intervention.

### **Issues of implementation**

Generally, the methods recommended in the Task Force on College Drinking (83) are based on non-judgemental, non-confrontational and non-authoritarian techniques. Regardless of this, the evidence-based methods that are used in preventing harmful alcohol consumption have to be accepted by the individuals and, if necessary, the organisation to which the person belongs. The programme has to be attractive and its purpose has to be understandable. In our studies the acceptance rates have been very high, indicating that these methods have fulfilled this criterion.

When intervening in an entire organisation, the intervention must be planned and implemented with representatives from the organisation itself. In our study we did a lot of work to secure support for the study among students representing the student body. This work included meeting with representatives from the Faculty of Engineering as well as representatives from the general student body on at least fifteen different occasions. These representatives have knowledge that the experts lack, and vice versa. This cooperation increases the chances of a stable and long-lasting prevention.

### **Screening and intervention**

All students have to be given the opportunity to assess their alcohol consumption during their years at university. This can be done at a general level, as in introduction meetings, or via the Internet. The assessment can also be offered to the students when they visit the Student Health Clinic. A personalised feedback on their consumption should be provided directly after the assessment. A simple questionnaire such as AUDIT, comprising 10 questions and with good specificity and sensitivity, could be used as an instrument.

As an alternative to personalised drinking feedback a 2x50-minute cognitive-behavioural programme could be used. Both the personalised drinking feedback and the cognitive-behavioural programme are designed to address high-risk drinkers. In addition to the high-risk drinking prevention it is possible to launch programmes in premises where the alcohol is consumed. The Responsible Beverage Service Programme for bartenders and students responsible for social events that serve alcohol has had positive effects on the patrons' blood alcohol concentration and can therefore be recommended.

## *Statistical issues*

### **Cluster randomisation**

In the pub study a cluster randomisation procedure was employed. There has been no previous randomised study in the field of responsible serving and we regard this as an important and necessary contribution to this research area. The only possible choice was a cluster randomisation procedure with the “nations” as the allocation unit. We found no significant intracluster correlations and assumed that it was zero, and performed the analyses using patrons as the unit of calculations. The editors and reviewers of the journal *Addiction* accepted this procedure.

Some recent papers criticise this procedure (117, 118). The main issue is that even small non-significant clusters influences, increase the confidence intervals of significance levels for the outcome variables. Correcting for this influence by using the allocation unit as the unit of statistical calculations has been suggested. In many cases this is a very conservative approach and more sophisticated methods have been developed based on multilevel methods (118), but these require a relatively large number of clusters (i.e. greater than 25). In the present study, using the “nations” as the allocation unit for the same calculations performed in Paper I, the significances of the alcohol levels and the atmosphere scorings disappear. We have not performed any multilevel types of statistics.

Future research in this area has to consider these objectives. It is important to increase the number of clusters in order to be able to use modern statistics in the analysis unless a design based on individual randomisation could be used.

### **Trajectory analysis**

More efficient statistical methods, such as trajectory analyses, have been developed in recent decades. These have facilitated the understanding of trends in the drinking patterns of young adults. These methods could be person-centred or variable-centred. Person-centred methods can be explained as approaches to understanding complex processes that characterise the individuals. These approaches assume that constellations or patterns of variables contribute to behavioural outcomes via the dynamic role they play within the total functioning of the individual. Variable-centred methods emphasise differences between individuals and seek to explain behaviour in terms of intercorrelations between variables. In longitudinal research the emphasis is on stability and change of variables rather than on the individual's development (119).

Using trajectory analyses makes it possible to identify developmental clusters within a population. When using only variable-centred methods, such as in logistic regression analyses, it could be difficult to identify different patterns of deviant trends (such as extreme drinking). An integrated variable-centred and person-centred analysis, such as a trajectory analysis, helps to identify those groups.

### ***Implications for future research***

There is a lack of evidence about the long-term effect of personalised drinking-feedback. Most studies have shown positive effects for up to six months (68, 92-94, 120), but based on quite small study samples (i.e. under 100 subjects). Therefore, future research should consider a long-term study based on all students at a university, and in a randomised way. Furthermore, the method of delivering the feedback varies between studies, but it appears that feedback could be effective whether delivered by mail, the Internet, or via face-to-face interviews (120). The method of delivering the intervention should also be considered in future research. The use of Internet-based feedback is a promising approach where the student can get feedback on their drinking without personal contact; this would make it easier for those who are reluctant to visit or meet clinicians concerning their alcohol consumption. In a feasibility study by Berndtsen et al. (121), the students appreciated the e-mail-based computerised feedback, and one-third of the females and one-fifth of the males believed that they would benefit from the feedback.

In countries where most young adults have access to mobile phones it could be possible to give the intervention via computerised feedback directly in their phones. This feedback could be requested whenever the person needed support concerning how to drink on a special occasion or on a regular basis. This area is still in the pioneer stage, and further research must be carried out. Both the Internet-based and mobile phone delivered feedback can be interpreted at the Student Health Clinic, and new guidelines have to be developed to facilitate this intervention.

## GENERAL CONCLUSIONS

- It proved possible to implement a responsible serving programme in a university setting. The implementation phase attracted only positive reactions. Breath alcohol levels were used as one of the main outcome variables for the first time in a controlled design. This method proved useful and had no serious drawbacks.
- In the efficacy study of the programme, alcohol levels among the patrons in the intervention pubs were decreased, and the 'rowdy' social atmosphere was calmer, compared with the patrons in the control pubs after one month. This indicated that the responsible beverage serving programme was initially effective. These differences disappeared at the five-month assessment, possibly due to leakage of effect from intervention servers to control servers.
- It proved possible to successfully implement intervention programmes for high-risk drinking freshmen at a university. Almost all students accepted participation, indicating acceptance of the programme, both by the individuals and the organisations they belong to.
- The efficacy study of the programme showed no significant differences between a more extensive cognitive behavioural skills training programme and a post-mailed minimal intervention in reducing alcohol consumption and related problems after one year, or during a three-year follow-up period.
- The three-year follow-up study of freshmen focused on both risky drinking and non-risky drinking. Sixteen percent had a stable high-risk drinking pattern level, 11 percent lowered their drinking pattern level from risky to non-risky and 13 percent raised their drinking pattern level from non-risky to risky. Sixty percent had a stable non-risky drinking pattern. Females are more often found in the decreasing group, while curriculum affiliation had no influence.

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# POPULÄRVETENSKAPLIG SAMMANFATTNING

Den totala alkoholkonsumtionen och intensivkonsumtionen är som högst i arton- till tjugofemårsåldern. Hög konsumtion är kopplad till ökad frekvens av skador och ökad risk för alkoholberoende. I slutet av 80-talet började man utveckla preventionsmetoder för universitetsstudier med riskkonsumtion och i början av 2000-talet sammanfattades kunskapsläget av det amerikanska vetenskapsrådet (NIAAA). Tre metoder bedömdes vara effektiva: 1) kognitiv färdighetsträning med normförtydligande och motivationsförstärkning, 2) motivationsförstärkande tekniker och 3) påverkan av alkoholförväntningar. Nyligen har ytterligare en metod utvecklats där den studerande informeras om sina alkoholvanor i relation till övriga studerande. Informationen kan ges skriftligen eller via Internet.

Förutom individuella insatser kan insatser riktas mot exempelvis servering av alkohol på studentpubar. Utbildning av bartenders har inte provats tidigare i universitetsmiljö men metoden har varit framgångsrik på vanliga barer.

I denna avhandling studeras två typer av interventioner: ansvarsfull alkoholservice och intervention vid riskkonsumtion av alkohol. I första studien utbildas bartenders i ansvarsfull alkoholservice och i andra studien provas olika metoder att intervensera på riskfylld alkoholkonsumtion. Före interventionerna gjordes initiala mätningar, därefter mättes effekterna efter 1 respektive 5 månader i barstudien och årligen i 3 år i högriskstudien. I barstudien användes en alcometer, vilken mäter halten alkohol i kroppen, samt en skala från 0 – 100 där gästerna får skatta stämningen på baren. I högriskstudien användes en enkät (AUDIT) som mäter alkoholkonsumtion, beroendenivå samt skador av alkoholen. I den första studien ingick 1,918 studenter (mätningar: initialt  $n=664$ , efter 1 månad  $n=658$ , efter 5 månader  $n=596$ ) som besökte någon av tolv barer under ordinarie pubkvällar. Medelåldern var 22 år och endast en person avböjde deltagande i studien. I den andra studien ingick 695 förstaårsstudenter. Medelåldern var 22 år och 660 (95%) accepterade att delta. De med AUDIT poäng över 10 (män) respektive 6 (kvinnor) betraktades som högriskkonsumenter, totalt 188 personer (27%). Utöver högriskgruppen ingick även en grupp lågriskkonsumenter ( $n=182$ ) som följdes upp på samma sätt.

I barstudien utbildades bartenderna ( $n=40$ ) i tekniker för att kunna hantera sin egen konsumtion och i tekniker för att undvika överservice av gästerna. I högriskstudien fick de högkonsumerande studenterna antingen genomgå en kognitiv utbildning eller så erhöll de en personlig dryckesfeedback. I det kognitiva programmet ingick beteendeträning, normförtydligande samt inträning av ett rationellt sätt att hantera alkoholkonsumtionen. Under programmet gavs en systematisk feedback av alkoholvanorna och de fick lära sig tekniker för att planera alkoholkonsumtionen vid fester. I den personliga dryckesfeedbacken fick



de information om sina egna alkoholvanor i relation till andras. Om de hade en skadlig alkoholkonsumtion rekommenderades de att minska den.

Det kognitiva programmet gavs i grupp (ca 8 personer) under fem veckor med två timmar vid varje tillfälle. Den personliga dryckesfeedbacken lämnades skriftligen per post.

Programmen kunde med framgång implementeras på ett universitet. I barstudien möttes vi bara av positiva reaktioner under implementeringsfasen och tekniken att mäta promillehalten i utandningsluften innebar inga komplikationer. Även den andra studien möttes av positiva reaktioner. Nästan alla valde att medverka, vilket tyder på att programmet accepterades av studenterna och studentkåren.

Resultaten av studierna redovisas i fyra olika artiklar varav två beskriver utbildningen i ansvarsfull alkoholserving, en beskriver metoderna för högriskkonsumerande studenter och en artikel beskriver dryckesförloppet under studietiden.

### **Ansvarsfull alkoholserving**

Vid den initiala mätningen var gästernas medianpromillehalt 0.82 ‰ och övre kvartilen (högsta 25%) 1.16 ‰.

En månad efter utbildningen fanns en skillnad på 0.11 ‰ mellan gästerna i de två grupperna, med lägre nivå på barer med utbildad personal. Samma gällde för den upplevda stökighetsgraden. Vid en senare uppföljningsmätning, efter fem månader, fanns det inte längre några skillnader. Det fanns inte heller några skillnader mellan män och kvinnor i våra resultat.

### **Program för högkonsumenter**

Vid den initiala mätningen rapporterade majoriteten (69% män och 71% kvinnor) att de drack alkohol 2 till 4 gånger i månaden och 55% av männen drack åtminstone 6 drinkar vid minst två tillfällen per månad. Motsvarande för kvinnor var 15%. Endast 3% av männen och 2% av kvinnorna drack aldrig alkohol.

Båda den långa och korta insatsen reducerade AUDIT poängen på ett statistiskt säkerställt sätt (kognitiv utbildning  $-1.7$  poäng och feedback  $-2.7$  poäng), men det förelåg ingen statistisk säkerställd skillnad mellan de olika programmen.

### **Dryckesförloppet under studenttiden**

Sexton procent hade ett stabilt högt riskfyllt konsumtionsmönster. Elva procent sänkte sin konsumtion från högrisk till lågrisk. Tretton procent från lågrisk till högrisk och sextio procent hade ett stabilt lågt konsumtionsmönster över alla fyra åren vid universitet. Kvinnor var överrepresenterade i gruppen som sänkte sin konsumtion. Det fanns inga skillnader mellan de som fått lång respektive kort intervention inte heller mellan typ av utbildningsprogram.

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